(54) Title: A METHOD OF ESTABLISHING THE PRESENCE OF SPECIFIC SUBSTANCES IN MILK AS WELL AS AN IMPLEMENT FOR APPLYING SAME

(57) Abstract

A method of establishing the presence of specific substances, such as contaminations, in the milk yielded from individual animals and obtained at consecutive milking runs, comprises the following steps: with the aid of a color sensor measuring system (9) the intensity of frequencies in a number of defined frequency bands, in particular the intensity of a number of defined colours in the milk, is established; the intensity values obtained are subsequently stored in a data file that is present for a relevant animal in a computer (13), whereafter these intensity values are compared both mutually and with corresponding intensity values recorded during one or more previous milking runs and the results of this comparison process are indicated.

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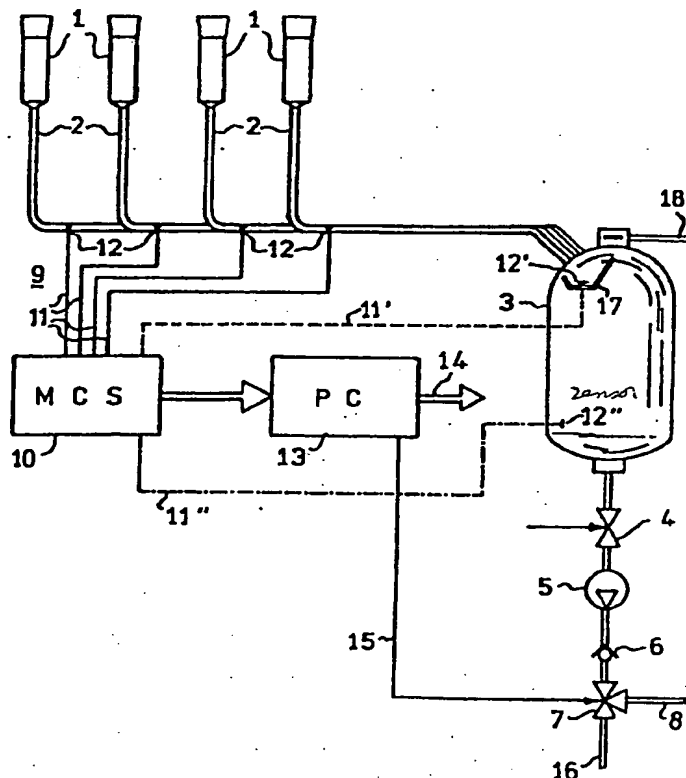|							
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A METHOD OF ESTABLISHING THE PRESENCE OF SPECIFIC SUBSTANCES IN MILK AS WELL AS AN IMPLEMENT FOR APPLYING SAME

The present invention relates to a method of establishing the presence of specific substances, such as contaminations, in the milk yielded from individual animals and obtained at consecutive milking runs.

Such a method is known from German Offenlegungsschrift 27 59 126. In this known method there is utilized a colour sensor reacting to the presence in the milk of contaminations, such as blood or pus. The invention aims at providing a more universal method of establishing the presence in the milk of specific substances, such as contaminations, in which method the composition of the milk, which is specific for each animal, is taken into account. In accordance with the invention, the method described in the preamble is characterized in that with the aid of a colour sensor measuring system the intensity of frequencies in a number of defined frequency bands, in particular the intensity of a number of defined colours in the milk, is established; that the intensity values thus obtained are stored in a data file that is present for a relevant animal in a computer; that these intensity values are compared both mutually and with corresponding intensity values recorded during one or more previous milking runs, and that the results of this comparison process are indicated. By means of the colour sensor measuring system, in particular the intensity of the individual colours in the milk obtained from the separate udder quarters can be established. According to the method described and depicted here, the intensity values established each time are compared with the previously

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established, so-called historical values therefor. This
method implies in particular that the intensity values
obtained at each milking run can be compared with correspond-
ing calibration values, while there can again be formed a
calibration value by the moving average of the intensity
values that have been obtained for a specific animal during a
defined number of most recent milking runs. When applying the
method described and depicted here it is furthermore impor-
tant that the results of the comparison process are rendered
in such a manner that the presence in the milk of specific
substances, such as contaminations, can be read directly
therefrom.

Besides to a method, the invention also relates to
an implement for applying the method described and depicted
here for establishing the presence of specific substances,
such as contaminations, in the milk yielded from individual
animals and obtained at consecutive milking runs. For that
purpose, the implement is characterized in that it is
provided with a colour sensor measuring system including one
or more sensors that are accommodated in the milk line
circuit of an automatic milking system to establish the
intensity of frequencies in a number of defined frequency
bands, in particular the intensity of a number of defined
colours in the milk, as well as a computer connected to said
colour sensor measuring system, in which computer the inten-
sity values thus obtained are stored in a data file present
therein for a relevant animal, and these intensity values are
furthermore compared both mutually and with corresponding
intensity values recorded during one or more previous milking
runs, while there are additionally provided means that are
connected to the computer for the purpose of indicating the
results of this comparison process. The sensors are
preferably disposed in the milk lines extending from each of
the teat cups of the automatic milking system. When it
appears from the comparison process that there are inadmis-
sible amounts of undesirable substances present in the milk,
the computer can supply a signal to a valve included in the
milk line system, via which valve the milk containing these
undesirable substances can be discharged separately.

For a better understanding of the invention reference will now be made to the accompanying drawing which shows schematically that part of an automatic milking system in which the application of the invention is expressed.

The drawing shows four teat cups 1 to be connected to the teats of an animal to be milked. The milk discharge hoses 2 of the teat cups 1 debouch into a milk glass 3. To the milk glass 3 there is furthermore connected a vacuum line 18 for applying an underpressure in the milk glass 3 itself, in the milk discharge hoses 2 and in the teat cups 1, which underpressure is required for keeping the teat cups connected to the teats of the animal, for milking and for separating milk and air present therein in the milk glass 3. Via a valve 4, a pump 5, a non-return valve 6 and a three-way valve 7, the milk obtained is discharged from the milk glass 3 through a line 8 to a (non-shown) milk tank.

The drawing additionally shows a colour sensor measuring system 9 comprising a colour intensity processing unit (MCS) 10, to which four sensors 12 are connected via glass fibre cables 11. These sensors 12 are accommodated in the milk lines 2 to establish the intensity of a number of defined colours in the milk and to supply signals representing these intensities to the processing unit 10. As colour sensor measuring system the Modular Color Sensor system CS1 of Stracon Messsysteme GmbH, Im Camisch 10, Kahla can be used. The sensors utilized in this system are sensitive to frequencies in frequency bands for red, green and blue. Therefore, per measurement there are supplied three signals which can be considered as intensity values for these three colours. For milk of a constant composition these three intensity values will have a fixed mutual relation, which relation, however, is disturbed as soon as the milk contains a contamination. To the colour sensor measuring system 9 there is connected a computer (PC) 13 in which for each animal to be milked there is present a data file in which all the data required for milking a relevant animal are stored. At each milking run also the obtained three intensity values of the relevant colours in the milk are recorded. These intensity values stored at each milking run constitute the

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so-called historical intensity values. From the historical intensity values, which have been obtained for a relevant animal during a defined number of most recent milking runs, the moving average can be determined. The intensity values obtained at a next milking run can be compared with this moving average, i.e. the most recently obtained intensity value of each of the three colours can be compared with the corresponding intensity value which is recorded as moving average in the computer. In other words, the intensity values are compared both mutually and with corresponding intensity values recorded during one or more previous milking runs. This comparison process takes place in the computer 13. Subsequently, the results of this comparison process can be rendered in such a manner that the presence in the milk of specific substances, such as contaminations, can be read directly therefrom. Via the line 14 these results can be supplied to a viewing screen or a printer.

Instead of determining the moving average of the intensity values for each of the colours, it is also possible to establish in an other manner a calibration value for each colour. It is possible to apply calibration values that could prevail for the milk obtained from all the animals. In that case it will not be necessary to dispose a sensor 12 in each of the milk discharge hoses 2, but it will be possible to dispose in the milk glass 3 an overflow reservoir 17 in which such a sensor 12' is accommodated, which sensor 12' is connected to the processing unit 10 via a glass fibre cable represented by a dashed line. As a further alternative, a sensor 12'' can be disposed in the lower part of the milk glass 3. Also in the latter case the sensor has to be connected to the processing unit 10 via a glass fibre cable 11''.

However, in all cases it applies that, when inadmissible amounts of undesirable substances appear to be present in the milk, there is supplied a signal by the computer 13 via the line 15 to the three-way valve 7, by means of which valve and the line 16 connected thereto the milk containing these undesirable substances can be discharged separately.

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When, for example, the milk is contaminated by blood, the intensity value supplied by the sensor 12 for the colour red will be higher than in case of milk free from blood. Then, the intensity value will be higher than the moving average established on the basis of the historical intensity values or higher than the calibration value applied. Also when the milk does not contain contaminations, there may be established changes in the concentration of substances that are normally present in the milk. For example, when in the course of the lactation period the fat content of the milk changes, the mutual relation of the three intensity values that are established during each milking run will change as well.

As the composition of the milk varies for different animals, which is even visually perceptible from the colour, the intensity values for the three colours will have a different mutual relation value for different animals. Therefore, it is advantageous to determine the intensity values for each animal individually at each milking run and to compare them with calibration values or, in particular, moving averages established for this specific animal.

CLAIMS

1.   A method of establishing the presence of specific
substances, such as contaminations, in the milk yielded from
individual animals and obtained at consecutive milking runs,
characterized in that with the aid of a colour sensor
measuring system (9) the intensity of frequencies in a number
of defined frequency bands, in particular the intensity of a
number of defined colours in the milk, is established; that
the intensity values thus obtained are stored in a data file
that is present for a relevant animal in a computer (13);
that these intensity values are compared both mutually and
with corresponding intensity values recorded during one or
more previous milking runs and that the results of this com-
parison process are indicated.

2.   A method as claimed in claim 1, characterized in
that by means of the colour sensor measuring system (9) the
intensity of the individual colours in the milk obtained from
the separate udder quarters is established.

3.   A method as claimed in claim 1 or 2, characterized
in that the intensity values obtained at each milking run are
compared with corresponding calibration values.

4.   A method as claimed in claim 3, characterized in
that there is formed a calibration value by the moving
average of the intensity values that have been obtained for a
specific animal during a defined number of most recent
milking runs.

5.   A method as claimed in any one of the preceding
claims, characterized in that the results of the comparison
process are rendered in such a manner that the presence in
the milk of specific substances, such as contaminations, can
be read directly therefrom.

6.   An implement for applying a method of establishing
the presence of specific substances, such as contaminations,
in the milk yielded from individual animals and obtained at
consecutive milking runs, which method is described in any
one of claims 1 to 5, characterized in that the implement is
provided with a colour sensor measuring system (9) including
one or more sensors (12) that are accommodated in the milk

line circuit of an automatic milking system to establish the intensity of frequencies in a number of defined frequency bands, in particular the intensity of a number of defined colours in the milk, as well as a computer (13) connected to said colour sensor measuring system (9), in which computer (13) the intensity values thus obtained are stored in a data file present therein for a relevant animal, and these intensity values are furthermore compared both mutually and with corresponding intensity values recorded during one or more previous milking runs, while there are additionally provided means that are connected to the computer (13) for the purpose of indicating the results of this comparison process.

7.   An implement as claimed in claim 5, characterized in that the sensors (12) are disposed in the milk lines (2) extending from each of the teat cups (1) of the automatic milking system.

8.   An implement as claimed in claim 6 or 7, characterized in that, when it appears from the comparison process that there are inadmissible amounts of undesirable substances present in the milk, the computer (13) supplies a signal to a valve (4) included in the milk line system, via which valve (4) the milk containing these undesirable substances can be discharged separately.
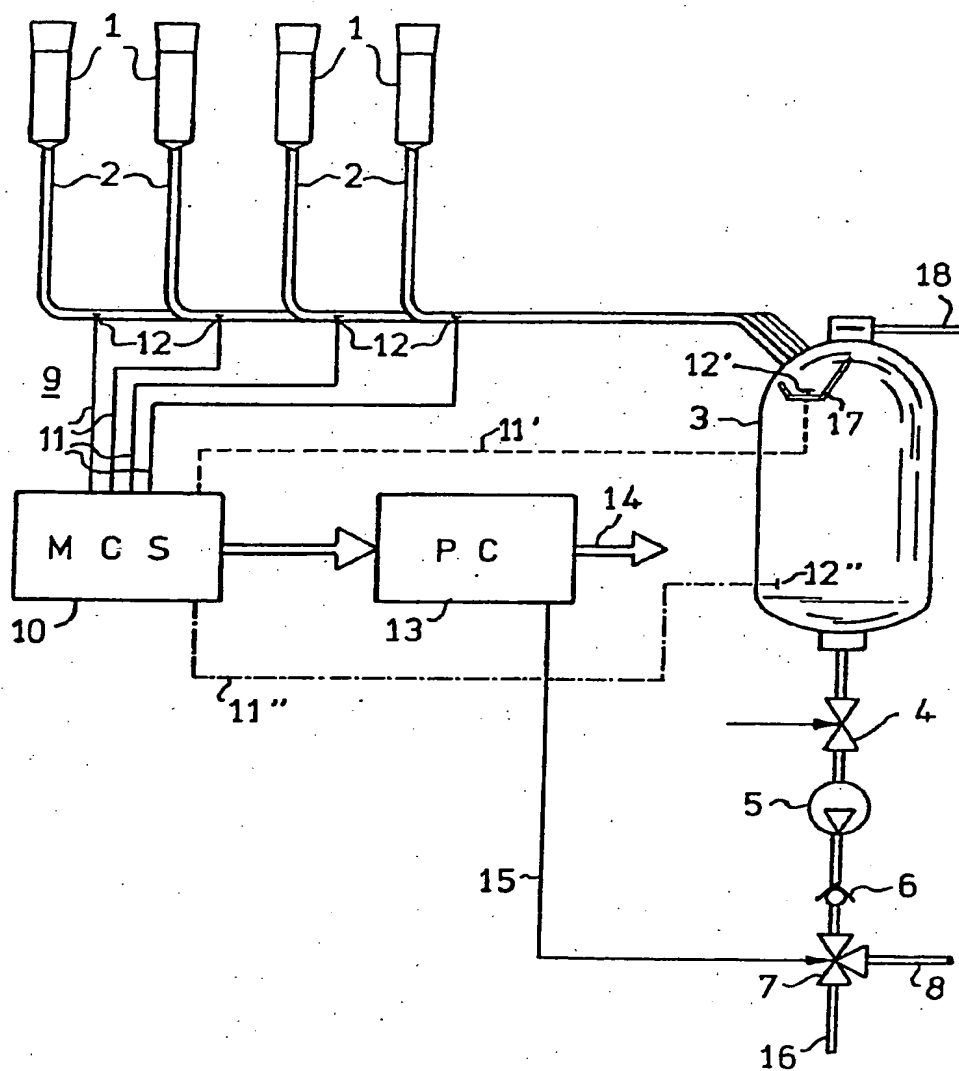
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6   A01J5/013   A01J7/00

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6   A01J   G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 190 020 A (BEDO ILONA ET AL) 26 February 1980 see column 2, line 32 - column 3, line 33 see claims; figures	1,6,8
A	DE 27 59 126 A (MEZOEGAZDASAGI FOEISKOLA) 12 July 1979 cited in the application see claims; figures	1
A	US 5 258 620 A (SUEYASU RYOICHI ET AL) 2 November 1993 see claims; figures	1
A	US 5 252 829 A (NYGAARD LARS ET AL) 12 October 1993 see claims; figures	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the International search	Date of mailing of the International search report
9 March 1998	17/03/1998

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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